

An Innovative Approach with Alice for Attracting K-12 Students to Computing *

[Extended Abstract]

Susan H. Rodger
Computer Science Department
Duke University
Durham, NC 27708
rodger@cs.duke.edu

ABSTRACT

We use the Alice programming language for attraction and retention of students to computer science.

1. INTRODUCTION

The U.S. Bureau of Labor Statistics expects a 1.15 million rise in the number of IT jobs over the decade 2002-2012. The concern with this rapid increase in available job openings is the decreasing number of students choosing to major in computing. According to the Computing Research Association's fall 2000 report, 23,416 students selected computer science or computer engineering as their intended major. In fall, 2004, this number was dramatically down to 15,950. Declining student enrollment in computing majors is only half the problem, however. We also have difficulty in retaining those students who do choose to major in computing.

We address the issues of attracting and retaining diverse group of students (especially women and underrepresented minorities) in computing by teaching students the Alice programming language. Alice has already proven successful with college students, in summer technology camps and in the girl scouts with middle school students.

Alice (www.alice.org) is a programming environment designed to enable novice programmers to create 3-D virtual worlds, including animated movies and games. Unlike most 3-D programming environments, Alice was designed through an iterative process of studying how novices tried to describe the motions of objects in a 3-D world. In Alice, 3-D models of objects (e.g. people, animals, and vehicles) populate a virtual world. Alice makes use of program visualization to allow students to immediately see how their animation

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programs run, enabling students to easily understand the relationship between the programming statements and constructs and the behavior of their animations.

We have two experiences with Alice. First, we have taught CompSci 4, an Alice course at Duke for non-majors for three semesters [1]. This course has over 50% women and minorities. These ratios are much higher than our other computer science courses which have 10-20% women and minorities.

Second, on Feb. 24, 2007, we taught approximately sixty 4th-6th grade girls how to build a basic Alice world as part of the Duke FEMMES program to introduce girls to science and engineering. This world included adding a snowman and snowwoman to their virtual world, adding functionality (methods) to them, and creating an event (pop the snowman's hat up and down whenever the "H" key is pressed). The materials for that event [1] include the sample world that was built.

For our future plans, the National Science Foundation has provided funding for six regional sites to teach Alice to high school and middle school teachers and for them to integrate Alice into their curriculum. The sites are Durham, NC, San Francisco, CA, Virginia Beach, VA, Denver, Colorado, Charleston, SC and Mississippi. Each site will be teaching Alice to high school and middle school teachers over the next three years.

The program at the Durham site will run as follows. Teachers from middle schools and high schools in the region will attend a three week summer workshop in summer of 2008 to learn Alice and develop materials. They will integrate Alice into their curriculum the following year and participate in additional Alice workshops and activities.

This project holds promise of an effective means of teaching object-oriented programming concepts and problem-solving skills to a large number of middle and high school students. The long-term impact to industry will be an increase in the number and diversity of students majoring in computer science.

2. REFERENCES

- [1] S. H. Rodger. Alice materials web site, 2007. www.cs.duke.edu/csed/alice.